comparing the condition signature with the normal signature, and registering an event if the condition signature differs from the normal signature by more than a predetermined threshold. By this arrangement, it is more easily accessible to facilitate the acquisition and analysis of the condition indicators in the overall health of a system.

Simani, on the other hand, discloses an input-output sensor fault detection and isolation by using state estimation (Fig. 3). That is, each output sensor signal has an observer, and each observer produces a respective residual (page 185, section 5). Further, Simani discloses that the simulations are concerned with two aspects, namely the generation of pattern for the NN training in the fault diagnostic validation (page 185, section 6). In other words, the first aspect is the generation of patterns of these residual from training data which contains different fault signal conditions for one of the input sensor signals (M_f), and the second aspect is the training of a multi-layer perception neural network, which takes the residual as inputs and predicts the underlying fault signal condition.

However, the approach taken by Simani is not the same health monitoring method and system of Applicants' claimed invention. In particular, Simani fails to disclose constructing a condition signature from a plurality of condition indicators including a plurality of vibration measurements acquired from the system, as recited in claim 1. As described in Applicants' specification on page 3, lines 13-20, the term "signature", as used herein, for example, pertains to the values of a plurality of condition indicators that is merged or fused into a unit or quantity (i.e., set, vector or scalar). In contrast, Simani discloses a plurality of unmerged residuals from the respective observers, wherein each observer is linked to an individual sensor or condition indicator (Fig. 3). Accordingly, Simani fails to disclose constructing a condition signature from a plurality of condition indicators, as recited in claims 1 and 8, and similarly recited in claims 17 and 18.

For argument sake, even if Simani's unmerged residuals can be considered a condition signature, the residuals in Simani are never compared with other "normal" residuals.. In fact, they are just used as inputs to the neural network. Further, Simani does not use thresholds to detect the faults. That is, the result of training Simani's neural network on data which contains different fault signal conditions is that the neural network can classify similar faults without recourse to such comparisons and thresholds. Accordingly, Simani fails to disclose or suggest the step of comparing the condition signature with the normal signature, as recited in claims 1, 8, 17 and 18.

Further, because Simani does not disclose or even suggest the concept of Applicants' condition signature, it cannot disclose or suggest the step of predicting a normal signature corresponding to a condition signature, as recited in claim 1, 8, 17 and 18. The Office Action alleges that page 183, section 2, first paragraph, and page 184, section 4, third paragraph in Simani, discloses the predicting step. However, it is respectfully submitted that Simani does not disclose a predicting step, but rather the equation for a discrete time, time-variant linear dynamic process, and only describes the type of classification performed by the neural network.

Further, the Office Action alleges, on page 183, section 3, third paragraph, and Fig. 3 in Simani, discloses constructing a condition signature from a plurality of vibration measurements. However, it is respectfully submitted that Simani fails to disclose or suggest that vibration measurements should be used as output sensor signals, and thus fails to disclose or even mention any vibration measurements.

Further, the Office Action alleges that on page 3, that on page 184, section 4, first paragraph in Simani, discloses the model is a learnt model comprising a neural network. However, it is respectfully submitted that the neural networks of Simani and the prior learnt model approach as taught in Applicants' claimed invention is completely different. In

particular, in the prior learnt model approach, as described on page 17, line 20-page 19, line 10 in Applicants' disclosure, the condition signature consists of two system measurements (e.g., the change in amplitude at current phase and a change in phase at the same amplitude). These measurements are also predicted by the output nodes of a neural network, which is a static model of a normal engine system (e.g., there is an obvious error in the application at page 18, lines 9-15, which one skilled in the art would immediately recognize and correct that the input nodes of the neural network are mistakenly associated with the condition signature). The predicted values from the neural networks are then compared with the actual measurements on the basis of the prediction area. However, the neural networks in Simani are merely used to classify the residuals which result from the operations. For example, in a gas turbine, Simani discloses that the engine system models which operate on single data are state-space models. Thus, the neural networks found in Simani are completely different from the prior learnt model approach as described in Applicants' claimed invention.

Thus, it is respectfully submitted that Applicants' claimed invention has the following significant advantages over Simani. Firstly, Simani requires that the input and output sensors must be distinguished between each other, whereas Applicants' invention discloses that the signals from the input and/or output signals can be used to construct the condition signature, which means there is no need to distinguish between the input and output sensors. Secondly, Simani requires the provision of training data that contains the known fault conditions, whereas Applicants' invention uses a model from which the normal signature can be predicted. This is highly significant as it will be extremely onerous to provide training data to cover all possible departures from the normality of a complicated system, such as a gas turbine. Finally, Simani's device is limited to detecting only sensor faults, whereas Applicants' invention can also respond to unexpected events or occurrences (e.g., abnormal blade rubbing due to released lock plate, oil seal leak, or bird strike) in the system being monitored.